Energy, Mines and Resources Canada

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L'Hon. Marcel Masse, Ministre

Canada

NATIONAL WIND TECHNOLOGY
FIELD OPERATION ASSESSMENT

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ABSTRACT

A survey of all wind turbines erected in Canada since 1970 has been conducted. The survey documents the number, type, generating capacity, and operational history of each wind turbine. It also contains comments by the wind turbine owners on technical, economic and regulatory issues.

Data obtained in the survey is intended to be useful to:

- the wind power industry, to improve their knowledge in the areas of marketing, product reliability and field service;
- federal and provincial governments, in the areas of energy research and development, economic and regulatory policies concerning taxation and electric utilities;
- electric utilities and other organizations, concerning technical and economic and regulatory aspects of grid-connected wind turbines and other future energy supply issues;
- wind turbine owners, in the areas of improving system reliability and increasing awareness of other owners;
- potential new wind turbine owners, who require consumer information to evaluate the viability of installing a system of their own.

RESUME

Ce rapport donne un relevé de toutes les éoliennes érigées au Canada depuis 1970 et décrit le nombre, le type, la capacité de production électrique, et le bilan opérationnel de chaque éolienne. Il présente également les commentaires de propriétaires d'éoliennes sur des questions techniques, économiques et de réglementation.

Les données obtenues dans le cadre de cette étude seront utiles:

- à l'industrie de l'énergie éolienne pour améliorer ses connaissances dans les domaines de la commercialisation, de la fiabilité du produit et du service sur le terrain;

- aux gouvernements fédéral et provinciaux dans les domaines de la recherche et du développement énergétiques, des politiques économiques et de réglementation concernant la taxation et les compagnies d'électricité;

- aux compagnies d'électricité et aux organismes en ce qui a trait aux aspects techniques, économiques et réglementaires des éoliennes reliées à un réseau d'alimentation en électricité, et aux autres questions d'approvisionnement en électricité à venir;

- aux propriétaires d'éoliennes dans les domaines de l'amélioration de la fiabilité des systèmes et de la sensibilisation d'autres propriétaires;

- aux propriétaires éventuels d'éoliennes qui ont besoin d'informations destinées aux consommateurs pour évaluer la rentabilité de l'installation éventuelle de leur système.

SOMMAIRE

Un relevé national a été entrepris à la fin de 1986 et au début de 1987 pour localiser et identifier toutes les éoliennes installées au Canada et décrire leur performance et leur fiabilité. Cette étude a montré que 280 éoliennes ont été érigées au Canada depuis 1970. De ce nombre, 250 unités avaient une capacité de production électrique totale de 1 193 kilowatts.

La capacité des 30 autres unités n'a pas pu être établie parce qu'on n'a pas rejoint les propriétaires ou parce que ces derniers n'ont pas répondu au questionnaire.

On a évalué à 500 le nombre d'éoliennes érigées au Canada depuis 1970. Cette estimation est probablement vraie, bien que le relevé n'en ait dénombré que 280, étant donné que la plupart des autres unités non dénombrées ne sont probablement que de petites installations utilisées pour charger des accumulateurs.

Le stockage de l'électricité dans des batteries d'accumulateurs a été choisi pour 67% des installations, la connexion à un réseau de distribution de l'électricité, pour 14% des installations, et 6% des installations ont été reliées à des systèmes de chauffage de l'eau ou de chauffage de bâtiments. Le type d'application des 13% qui restent n'est pas connu parce qu'on n'a pas rejoint les propriétaires ou parce que ces derniers n'ont pas répondu au questionnaire.

Le plus important type d'application mis en évidence par cette étude est l'alimentation en électricité de maisons et de résidences secondaires (49% des éoliennes). Les aides à la navigation et les services de

télécommunication représentent 25% des éoliennes, et diverses applications allant de l'alimentation en électricité sur place à l'alimentation d'appoint d'un réseau à groupe électrogène diesel représentent 6%. Trois pour cent des éoliennes ont été utilisées dans diverses applications institutionnelles, tandis que l'utilisation des 13% qui restent est inconnue.

Le relevé a dénombré 204 propriétaires d'éolienne et une questionnaire a été envoyé à 186 d'entre eux. Dix-neuf des 186 propriétaires avaient déménagé. Cent ont répondu au questionnaire et ont fourni des détails sur leurs projets et ont fait des commentaires sur des sujets connexes. Les autres ayant reçu un questionnaire n'ont pas répondu. Le tableau 2 donne une répartition détaillée des réponses.

Quelques-uns des répondants avaient à un moment donné plus d'une éolienne en service, ou ont remplacé une ancienne éolienne par une nouvelle. Le nombre total des éoliennes et leur état de fonctionnement sont indiqués au tableau 3.

Soixante-douze des 280 éoliennes dénombrées sont actuellement en service et 19 le seront de nouveau, après interruption temporaire. Soixante-dix des 72 éoliennes en service fournissent une capacité électrique totale de 601 kW. Dix-huit des 19 unités qui devraient recommencer à fonctionner représentent une capacité totale de 231 kW. Lorsque ces dernières seront de nouveau en service, les 88 éoliennes produiront 832 kW, en plus des deux unités maintenant en opération et l'autre qui le sera bientôt et dont on ne connaît pas la capacité de production électrique. Ces 88 éoliennes représentent 50% de la capacité installée connue de 1193 kW et 28% de ces 250 éoliennes.

TABLEAU 2 : PROPRIÉTAIRES D'ÉOLIENNES QUI ONT RÉPONDU AU QUESTIONNAIRE

PROVINCE	RÉPONSES	DÉMÉNAGÉ	INCONNU*	PAS DE RÉPONSE	TOTAL
Alberta	9	0	1	7	17
C.-B.	19	7	7	13	46
Manitoba	4	0	0	3	7
N.-B.	7	0	0	3	10
T.-N.	1	0	0	2	3
T.N.-O.	1	1	0	1	3
N.-É.	17	3	6	13	39
Ontario	23	6	1	15	45
Î.-P.-É.	7	0	0	1	8
Québec	5	2	3	5	15
Sask.	5	0	0	3	8
Yukon	2	0	0	1	3
Canada	100	19	18	67	204

* Adresse non disponible

TABLEAU 3: ÉTAT DE FONCTIONNEMENT DES ÉOLIENNES DU RELEVÉ

PROVINCE	À L'ARRET	ÉTAT INCONNU	EN MARCHE	BIENTÔT EN MARCHE	TOTAL
Alberta	15	2	14	1	32
C.-B.	20	28	12	3	63
Manitoba	2	3	3	0	8
N.-B.	7	4	1	0	12
T.-N.	0	2	1	0	3
T.N.-O.	0	3	1	0	4
N.-É.	10	21	12	6	49
Ontario	15	19	19	5	58
Î.-P.-É.	1	0	5	3	9
Québec	13	5	2	1	21
Sask.	2	4	2	0	8
Yukon	12	1	0	0	13
Canada	97	92	72	19	280

Note: la colonne réservée aux éoliennes à l'arrêt ne comprend pas les éoliennes dénombrées dans la colonne des unités bientôt en marche.

Quatre-vingt-dix-sept éoliennes dénombrées dans l'étude avaient été démantelées ou avaient cessé de fonctionner pour une raison quelconque, soit parce que le propriétaire avait déménagé, que l'éolienne n'était pas fiable, que le site n'était pas approprié, ou que l'application n'était que temporaire. L'état opérationnel des 92 éoliennes dénombrées dans l'étude n'a pas pu être établi parce que les propriétaires avaient déménagé ou qu'ils n'avaient pas répondu à la questionnaire.

Les propriétaires d'éoliennes ont répondu aux questions portant sur la performance du système, la fiabilité, la vitesse du vent, et les conditions météorologiques, et ils ont fait des commentaires et des suggestions sur des sujets techniques, économiques et réglementaires intéressant les fabricants et les fournisseurs d'éoliennes et d'équipement connexe, les compagnies d'électricité, les gouvernements fédéral et provinciaux, d'autres propriétaires et propriétaires éventuels.

Les interruptions signalées étaient dues à des défaillances mécaniques comme des pales brisées ou la nécessité de remplacer des pièces usées comme des brosses de génératrices ou des pièces endommagées comme des bobinages corrodés des génératrices.

Les programmes de subvention gouvernementales ont eu un impact considérable sur un certain nombre de systèmes installés dans les Maritimes entre 1980 et 1985, mais cet impact est disparu lorsque les programmes ont pris fin.

Le nombre des éoliennes installées au cours des trois dernières années est inférieur à celui des années précédentes, mais étant donné que les nouvelles éoliennes sont plus puissantes, la capacité de production d'électricité augmente plus rapidement.

Les renseignements obtenus dans ce relevé peuvent être utiles pour améliorer la fiabilité et la rentabilité des éoliennes, le service d'avant et d'après-vente, l'engagement et l'appui du gouvernement en ce qui a trait à l'utilisation de l'énergie éolienne, et pour résoudre certaines problèmes qui, selon les propriétaires d'éoliennes, font obstacle à d'autres installations.

EXECUTIVE SUMMARY

A national survey to locate and identify all wind turbines installed in Canada and document their performance and reliability was conducted in late 1986 and early 1987. The survey has found that 290 wind turbines have been erected in Canada since 1970. Of these, 250 units accounted for a total of 1 193 kilowatts of generating capacity.

The generating capacity of the remaining 30 units could not be determined because the owners could not be contacted or did not respond to the survey.

It has been estimated that as many as 500 wind turbines have been erected in Canada since 1970. This estimate may prove to be accurate, even though only 290 turbines were detected in the survey, because most of the remaining, undetected units would be small battery-charging machines.

The storage of electricity in battery banks was selected for 67% of the machines; connection to an electric utility distribution grid was selected for 14% of the machines; and 6% of the machines were connected to electric water or space heating systems. The type of application of the remaining 13% is unknown because the owners could not be contacted or did not respond to the survey.

The largest type of application detected by the survey is residential and cottage power supply, which accounts for 49% of the turbines. Navigational aids and telecommunications services account for 25% of the turbines, and various corporate applications ranging from on site power

supply to feeding power into an autonomous diesel-electric grid account for 6%. Four percent of the turbines went to various institutional applications while the applications of the remaining 16% is unknown.

The survey detected 204 wind turbine owners and a questionnaire was sent to 196 of them. Nineteen of the 186 owners had moved away. One hundred responded to the questionnaire and provided details about their projects and comments about related topics. The remaining number of questionnaire recipents did not respond. Page xi shows a breakdown of the survey response rate.

Some of the owners had more than one wind turbine operating at one time, or replaced an older machine with a new one. The total number and operations status of all machines is shown on page xi.

Of the total 280 turbines, 72 are now operating and 19 are expected to operate again soon. Seventy of the 72 operating turbines account for a total of 601 kW of generating capacity. Eighteen of the 19 units expected to operate again represent a total of 231 kW. When these turbines return to service, a total of 88 machines will account for 832 kW of capacity, along with two units now operating and the one soon-to-operate for which the generating capacity was not detected by the survey. The 88 machines account for 50% of the known installed capacity of 1 193 kW and 28% of those 250 turbines.

Turbine owner response rate in the survey

PROVINCE	RESPONSES	MOVED	UNKNOWN*	NO RESPONSE	TOTAL
Alberta	9	0	1	7	17
B.C.	19	7	7	13	46
Manitoba	4	0	0	3	7
N.B.	7	0	0	3	10
Nfld.	1	0	0	2	3
N.W.T.	1	1	0	1	3
N.S.	17	3	6	13	39
Ontario	23	6	1	15	45
P.E.I.	7	0	0	1	8
Quebec	5	2	3	5	15
Sask.	5	0	0	3	8
Yukon	2	0	0	1	3
Canada	100	19	18	67	204

* No address available

Status of Wind Turbines Detected in Survey

PROVINCE	STOPPED*	UNKNOWN	RUNNING	TO RUN	TOTAL
Alberta	15	2	14	1	32
B.C.	20	28	12	3	63
Manitoba	2	3	3	0	8
N.B.	7	4	1	0	12
Nfld.	0	2	1	0	3
N.W.T.	0	3	1	0	4
N.S.	10	21	12	6	49
Ontario	15	19	19	5	58
P.E.I.	1	0	5	3	9
Quebec	13	5	2	1	21
Sask.	2	4	2	0	8
Yukon	12	1	0	0	13
Canada	97	92	72	19	280

* Does not include turbines in the column of machines expected to run again.

Ninety-seven machines detected in the survey had been dismantled or had otherwise stopped operating because the owner moved, the turbine was not reliable, the site was not appropriate, or the application was a temporary one to begin with. The operational status of 92 turbines detected in the survey could not be determined because the owners moved away or did not respond to the survey.

Turbine owners responded to questions concerning system performance, reliability, wind speeds and weather conditions, and provided comments and suggestions on technical, economic and regulatory topics of interest to manufacturers and suppliers of wind turbines and accessory equipment, electric utilities, federal and provincial governments, other owners and potential owners.

Interruptions reported in turbine operation were due to mechanical failures such as broken blades, or a need to replace worn parts such as generator brushes or damaged parts such as rusted generator windings.

Government grant programs made a significant impact in the number of systems installed in the Atlantic Provinces from 1980 to 1985 but this impact disappeared when the programs were terminated.

The number of turbines installed from 1983 to 1986 is lower than in previous years, but because most of the new turbines are larger, wind generating capacity is increasing at a higher rate.

Information obtained in the survey can be useful in efforts to improve turbine reliability, economics, pre-sales and after-sales service, government involvement with a support for wind power utilization, and toward resolving issues perceived by the wind turbine owners to be a barrier to further installations.

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INTRODUCTION

This report documents the execution of a national survey of wind turbines erected since 1970. The six-month project began in September 1986, funded by the Solar Energy Development Program of the Federal Department of Energy, Mines and Resources (EMR) and conducted entirely by World Wind Communications Co. of Ottawa.

1. OBJECTIVES

The purpose of the project was to determine how many wind turbines have been erected in Canada since 1970 and to locate as many of them as possible to document the application and operational history of each machine.

The number of machines erected in Canada is thought to be a function of factors such as:

- the distribution of wind power resources across the country;
- population density in regions with strong wind resources;
- the availability and cost of other energy sources in those regions;
- the availability, cost and reliability of commercially available wind turbines;
- the number of technically-, ecology-, or entrepreneurially-minded individuals in windy regions.

By documenting the wind turbine market, as evidenced by the number of machines and the performance and reliability of each turbine, the survey can provide information useful to turbine suppliers and

OBJECTIVES (Cont.)

manufacturers who are in the market or those who are considering entry into it, to the turbine owners themselves and to others interested in becoming owners, to provincial and federal governments that regulate the market or that fund research and development activity for wind power industry, and to electric utilities with strong wind resources in their service territories.

2. METHOD

To locate as many wind turbine owners as possible, an intensive literature search was conducted. Documents examined included newspapers and magazine articles, introductory books on wind power and renewable energy published in Canada, reports published under the federal-provincial Conservation and Renewable Energy Demonstration Agreement programs which concluded in 1984, and other federal and provincial reports. Further information came from EMR, and from turbine suppliers and owners.

After obtaining references to the existence of wind turbines at specific sites, the surveyors obtained the postal address of turbine owners. An introductory letter describing the project and its purpose was mailed to each owner, followed by a questionnaire for the owner to complete and return. Specimens of the introductory letter and the questionnaire are included in Appendix 1 of this report.

As the letters and questionnaires were mailed out to the owners, a table was compiled containing preliminary data obtained during the literature search. These data consisted of the owner's name, address, type and generating capacity of the turbine, year of installation, and the turbine's application and operational status. Some of this information was estimated.

METHOD (Cont.)

Returned questionnaires were sorted alphabetically by province and owner. Data fields in the above-mentioned table were expanded to include further information such as weather conditions and the topography of the site of the owner's turbine. In its final form, the table constitutes Appendix 2 of this report.

A statistical analysis was made of the data provided by turbine owners who responded to the survey. The results of this analysis are documented in tables as well as lists of comments made by the owners as requested in the questionnaire. These tables and lists, can be found in Appendix 3.

Some of the questions required the wind turbine owner to provide a subjective answer because in some instances, an objective answer would have been impossible for most owners. For example, rather than ask the owner what the annual average wind speed is at the turbine site, they were asked whether or not the turbine provided enough energy when it was running reliably. The owners were also asked if the turbine output varied little or considerably during the seasons and whether or not that variation had an affect on the owner's consumption habits. If the owner believed wind speeds were generally too low, he could volunteer this information.

DATA AND ANALYSIS

1. RESPONSE TO THE QUESTIONNAIRE

A total of 204 wind turbine owners across Canada were detected during the literature search and subsequently in this project. Some of these owners operated more than one machine at one time or replaced an older machine with a new one. The postal address for 1 854 turbine owners was obtained to send them the introductory letter and the questionnaire. Some addresses simply could not be obtained.

Of the 185 introductory letters mailed, 19 came back because the owner had moved away. Of the remaining 166 owners, 100 responded to the questionnaire. They represent 59% of the owners for whom an address was obtained or 48% of the total number of owners detected in this project.

A provincial breakdown of the number of survey respondents, owners who moved or could not be located, and owners who did not respond to the questionnaire is shown here in table 1.

RESPONSE TO THE QUESTIONNAIRE (Cont.)

TABLE 1: Turbine Owner Response Rate to the Survey

PROVINCE	RESPONSES	MOVED	UNKNOWN*	NO RESPONSE	TOTAL
Alberta	9	0	1	7	17
B.C.	19	7	7	13	46
Manitoba	4	0	0	3	7
N.B.	7	0	0	3	10
Nfld.	1	0	0	2	3
N.W.T.	1	1	0	1	3
N.S.	17	3	6	13	39
Ontario	23	6	1	15	45
P.E.I.	7	0	0	1	8
Quebec	5	2	3	5	15
Sask.	5	0	0	3	8
Yukon	2	0	0	1	3
Canada	100	19	18	67	204

* Address never found.

Nearly all respondents answered most of the questions on the questionnaire. Very few indicated they were confused by any of the questions. However, question 1Q was frequently misinterpreted.

Question 1Q asked the owner to identify if the turbine was bought through a supplier rather than directly from the manufacturer, and if so, to name the supplier. Some owners thought this question referred to the tower of the wind turbine and not the machine itself.

2. PRESENTATION OF DATA

The specific data and questionnaire responses are presented in two forms in this report. First, the main data and statistics are contained in table 8 found in appendix 2, which lists by province:

- the owner's family name and the town or region;
- the manufacturer of the wind turbine and the rated generating capacity of the turbine;
- the tower type and height;
- the year of installation and type of application;
- current operational status or year of decommissioning and, a pertinent note on the status or other topics;
- the type of wind conditions at the site and the topography of the site where the owners have mentioned them.

Second, owner responses to some specific questions that appear separately in other tables can be found in Appendix 3.

3. NUMBER AND TYPE OF WIND TURBINES

The survey found that 280 wind turbines were erected in Canada from 1970 through early 1987. This total does not include any machines erected at the Atlantic Wind Test Site in P.E.I. or the Lethbridge Wind Research Site in Alberta, nor any "prototype" turbines erected for the National Research Council or other organizations as listed in table 2 on page 7. These machines are prototypes erected solely for research and are not examples of commercially-available turbines built for other commercial projects. Home-built turbines however, are included in the survey because they were constructed by or for the owner to supply energy just as if the owner had purchased a machine from a manufacturer.

NUMBER AND TYPE OF WIND TURBINES (Cont.)

TABLE 2: Turbines not Included in the Survey

MANUFACTURER	CAPACITY	SITE	SPONSOR
Adecon	70 kW	Toronto, Ontario	OME
Adecon	120 kW	North Cape, P.E.I.	NRC
Bergey	1 kW	North Cape, P.E.I.	AWTS
Bowjon	pumper	Lethbridge, Alberta	LWRS
Bristol	Various	various	NRC
Deltx	pumper	Lethbridge, Alberta	LWRS
Deltx	pumper	Calgary, Alberta	ACERRF/NRC
Dempster	pumper	Lethbridge, Alberta	LWRS
Dunlite	2 kW	North Cape, P.E.I.	AWTS
Enertech	1.8 kW	Lethbridge, Alberta	LWRS
Extrawatt	4 kW	North Cape, P.E.I.	OME
Indal	4 kW	North Cape, P.E.I.	NRC
Indal	50 kW	Christopher Point, B.C.	NRC
Indal	50 kW	Swift Current, Sask.	NRC
Indal	50 kW	Churchill, Man.	NRC
Indal	50 kW	Holyrood, Nfld.	NRC
Indal	50 kW	Sudbury, Ontario	OME
Indal	50 kW	North Cape, P.E.I.	NRC
Indal	50 kW	Varennes, Que.	IREQ
Indal	230 kW	Magdalen Is., Que.	IREQ/NRC
Indal	500 kW	North Cape, P.E.I.	NRC
Marapat	12 kW	Lethbridge, Alta.	LWRS
Massey	pumper	Lethbridge, Alta.	LWRS
McPherson	pumper	Lethbridge, Alta.	LWRS
North Wind	9 kW	North Cape, P.E.I.	HWC
Nor'wester	1.2 kW	Lethbridge, Alta.	LWRS
Vickers	3 800 kW	Cap Chat, Que.	IREQ/NRC
Wind Baron	pumper	Lethbridge, Alta.	LWRS
Wind Dynamics	pumper	Lethbridge, Alta.	LWRS
Wellington	5 kW	North Cape, P.E.I.	OME

Agencies:
- ACERRF - Alberta-Canada Energy Resources Research Fund
- AWTS - Atlantic Wind Test Site
- HWC - Department of Health and Welfare (federal)
- IREQ - Institute of Research of Hydro-Quebec
- LWRS - Lethbridge Wind Research Site
- NRC - National Research Council
- OME - Ontario Ministry of Energy

NUMBER AND TYPE OF WIND TURBINES (Cont.)

The manufacturer of 16 of the 280 turbines detected in the survey is not known, mainly because they belong to owners who moved or could not be located. Of the remaining 264 units, 46 were home-built, typically constructed by the owner. The rest were built by 27 wind turbine manufacturers in Canada and in 6 other countries. Table 3 lists the number of manufactured, home-built and turbines of unknown origin erected in each province. Manufacturers of less than three machines detected in the survey are not included in table 3.

Twelve of the companies account for 196 machines. Of that number, 4 Canadian companies manufactured 47 turbines. Other commercially manufactured wind turbines erected in Canada were imported. Some were purchased second-hand from previous owners in Canada. Domestically manufactured wind turbines appeared in Canada in the late 1970s.

It has been estimated that as many as 500 wind turbines have been erected in Canada since 1970. Just over one-half of that estimate was detected by this survey. The estimate may still be accurate especially if most of the undetected turbines are small battery-charging machines, and also since the estimate included the "prototype" turbines not included in this survey that appear in table 2.

NUMBER AND TYPE OF WIND TURBINES (Cont.)

TABLE 3: Major Manufactured and Home-built Wind Turbines

PROVINCE	MANUFACTURER OR TYPE														
	B	C	CE	D	E	G,K,L	HB	J	N	T	V	W	WTG	Y	TOTAL
Alberta	2	0	0	2	7	0	12*	1	2	1	0	4	0	0	31
B.C.	0	0	5	31	1	0	2	1	3	0	1	13	4	0	61
Manitoba	1	0	0	0	2	0	3	0	0	0	0	0	0	0	6
N.B.	0	0	0	4	1	1	1	0	1	0	0	0	0	1	9
Nfld.	0	0	0	0	1	0	0	0	1	0	0	1	0	0	3
N.W.T.	0	1	0	0	0	0	0	2	0	0	0	0	0	1	4
N.S.	1	3	0	6	3	1	9	2	0	1	2	7	7	0	42
Ont.	1	5	1	2	1	0	11	5	1	6	1	2	1	14	51
P.E.I.	4	0	0	0	2	0	2	1	0	1	0	0	0	0	10
Que.	0	7	0	2	0	5	3	1	0	0	0	0	2	0	20
Sask.	0	0	0	1	0	0	3	0	0	0	0	1	2	0	7
Yukon	0	0	0	1	0	0	0	0	0	0	0	11	0	1	13
Canada	9	16	6	49	18	7	46	13	8	9	4	39	16	17	257

Key:

B	- Bergey	(USA)	HB	- Home-built	
C	- Aerowatt	(France)	J	- Jacobs	(USA)
CE	- Canergy	(Cdn)	N	- North Wind	(USA)
D	- Dunlite	(Australia)	T	- Thermax	(Cdn)
E	- Enertech	(USA)	V	- Whirlwind	(USA)
G,K,L	- Extrawatt, Heliowatt and Heli-O-Beauce	(Cdn)	W	- Wincharger	(USA)
			WTG	- Unknown	
			Y	- Wellington	(Cdn)

Note: These letter codes also used in table 8, appendix 2.

* All of the home-built turbines in Alberta were actually made in the shops of the Suncor Co. (using Wincharger blades) to power telemetry instrumentation in northern petroleum-related applications.

4. TYPES OF ENERGY APPLICATIONS

One reason for one company selling more turbines than another in Canada is the type of market demand that exists in each type of application. Of the total 280 machines, the kind of application in which 36 machines were used is unknown. Of the remaining 243 installations, 187 employ batteries to store electricity and 38 employ utility grid-connected operation without electrical storage. Among the 204 detected owners, 138 installed wind turnines at a home or cottage and 71 installed turbines for navigational aid or telecommunications service. Tables 4 and 5 show the number of turbines installed in each type of application in each province. Hence, the largest demand for machines has been for battery-charging in residential and remote-site applications.

TABLE 4: Type of Energy Application

PROVINCE	APPLICATION				
	Grid	Battery	Heat	Pumping	Unknown
Alberta	8	23	0	0	1
B.C.	3	54	0	0	6
Man.	3	3	1	1	0
N.B.	2	8	2	0	0
Nfld.	1	2	0	0	0
N.W.T.	1	2	1	0	0
N.S.	7	25	5	1	11
Ont.	4	41	4	0	9
P.E.I.	3	4	2	0	0
Que.	3	11	2	0	5
Sask.	3	2	0	0	3
Yukon	0	12	0	0	1
Canada	38	187	17	2	36

Note: Unknown because owners could not be contacted or did not respond.

During the mid-1970s, the primary source for battery-charging turbines having a generating capacity of a few hundred watts was the Winco Division of Dyna Technology. This firm has been manufacturing its 200-watt "Wincharger" model in the U.S. since the 1940s, and has sold

more turbines of under one-kilowatt capacity in Canada than any other company, mainly to residents on the coast of British Columbia and also to the petroleum industry for temporary scientific measurements in the Beaufort Sea.

The next largest source of battery-charging turbines erected in Canada under one-kilowatt was Société Aerowatt S/A of France. All of these Aerowatt machines went for non-residential applications, such as telecommunications or navigational aids. Marketed as a high-reliability machine for unattended operation, the Aerowatt turbine is significantly more expensive than the Wincharger.

The primary source for turbines having a capacity of a few kilowatts in the 1970s was the Dunlite Co. of Australia. This firm has been manufacturing one- and two-kilowatt machines since the 1960s. Most were sold to residents and to the Canada Coast Guard for their lighthouses in British Columbia before 1981.

TABLE 5: Types of Turbine Application

	*Res.	Nav.	Corp.	Tele.	Inst.	Farm	Green	Unknown
Alberta	8	0	0	18	2	3	0	1
B.C.	40	12	0	5	0	0	0	6
Man.	5	0	0	0	0	2	1	0
N.B.	6	1	2	3	0	0	0	0
Nfld.	2	0	0	1	0	0	0	0
N.W.T.	2	1	1	0	0	0	0	0
N.S.	31	0	2	3	1	0	1	11
Ont.	29	5	7	3	5	0	0	9
P.E.I.	7	0	1	0	1	0	0	0
Que.	3	2	3	6	2	0	0	5
Sask.	4	0	1	0	0	0	0	3
Yukon	1	0	0	11	0	0	0	1
Canada	138	21	17	50	11	5	2	36

*Applications: Res.-residential, Nav.-navigational aid, Corp.-commercial, Tele.-telecommunications, Inst.-institutional, Green-Greenhouse water circulation.

TYPES OF ENERGY APPLICATIONS (Cont.)

After Dunlite, the largest source of battery-charging wind generators in Canada of a few kilowatts of capacity has been from the domestic firm Wellington Windpower Co., which began marketing machines in Ontario during the late 1970s.

Wind turbines designed for operation connected to the electric utility distribution network without a battery storage system became available in the U.S. at the end of the 1970s. At that time, legislation was passed in the U.S. to ensure that the electric utilities encouraged grid-connectior by small power producers and customer-owned generators to avoid penalizing the generator owner. Such legislation has not been passed in Canada but many domestic utilities permit interconnection, some only on an experimental basis, and others in "net energy billing" or "energy banking" applications.

Of the 280 turbines detected in the survey, 38 are known to have been grid-connected. Some of these were erected by the utilities themselves in demonstration projects, but most were erected as utility, customer-owned generators. Most were manufactured by the Enertech Corp. in the U.S. and only one machine was built by a domestic company.

Most of the grid-connected turbines erected in Canada were in Nova Scotia, but the situation changed in 1984 when the "energy banking" policy was introduced in Alberta; since then, most grid-connected turbines have been erected in Alberta. While the earlier units typically have a generating capacity of a few kilowatts, most of the newer machines are between 20 and 60 kW. This also explains why the newer machines installed in Canada account for a larger total generating capacity than the greater number of installations in previous years.

TYPES OF ENERGY APPLICATIONS (Cont.)

Seventeen turbines detected in the survey were erected to generate electricity for water or space heating, using a large water storage tank or serving some heating elements in conventional home hot water tanks. Most were installed in Maritime provinces, with Nova Scotia taking the lead.

5. PERFORMANCE

The performance of each wind turbine is dependent upon several factors: the strength of the wind resource at the turbine site and the height of the turbine's tower; the seasonal variation of wind speeds and the amount of atmospheric turbulence; and the reliability of the machine itself. Freezing rain can also be a factor, but only during brief periods.

Reports about freezing rain, atmospheric turbulence, seasonal wind speed variation, and the topography of turbine sites, appears in the column "W/S" in the table 8 of appendix 2.

Eight owners reported not having enough wind at their sites. Two are in B.C., two in Alberta, one in New Brunswick and one in the Ottawa region of Ontario.

Fifty-four survey respondents reported significant seasonal variations in wind speeds at their turbine sites and 30 of these said the variation affects their energy consumption habits. None of the 30 have grid-connected turbines. A group of 19 owners said their turbines do not adequately meet energy demand when the machines are running reliably. Ten of the 19 owners also belong to the above-mentioned group of 30 who said the seasonal variation in wind speeds affects their energy

consumption habits. Four of those 10 owners also belong to the above-mentioned group of 8 who reported winds are inadequate at their sites. Some of these owners actually meant that their turbine does not adequately meet their energy demands during some seasons only.

It is possible that some of these owners installed a wind turbine that is not large enough to meet the energy demand expected of it. Survey respondents listed their various electrical loads, but not enough of them did to make a comparison of turbine capacity and consumption loads possible.

Nearly all of the turbine owners who said their turbines do not adequately meet their energy demands used towers shorter than 50 feet. One exception is an owner in the Ottawa region of Ontario, who installed a tower higher than 60 feet.

Twenty-one owners said the winds are turbulent at their turbine sites and 30 owners said winds are smooth. Ten of the 30 owners reporting smooth winds installed turbine towers shorter than 50 feet tall.

Thirty-five owners reported that ice had accumulated on their turbines from either freezing rain or hoar frost. Seventeen of these owners are in the Maritime provinces, 11 being in Nova Scotia, and between 1 and 3 owners in each other province and both territories.

Of the 35 owners who reported ice accumulation, 23 said the accumulation of ice has had some effect on the operation of their turbines. One owner noticed that this accumulation once caused turbine power output to drop significantly, but only for a few hours. A few other owners said they would "furl" or shut down their machines and avoid operation during freezing rains.

6. TURBINE RELIABILITY

Of the 280 turbines detected by the survey, the current operating status of 92 units is not known because their owners could not be contacted or did not respond to the survey. One-hundred-sixteen of the remaining number of machines are not operating. About 40 of the 116 machines were dismantled because the owner has moved, because the installation was a temporary one to begin with, or because they were replaced by photovoltaic or utility grid power. Nineteen of the 116 machines are expected to return to operation after a temporary interruption. Table 6 shows the operational status of the turbines detected in the survey.

TABLE 6: Status of Wind Turbines Detected in the Survey

PROVINCE	STOPPED	UNKNOWN*	RUNNING	TO RUN	TOTAL
Alberta	15	2	14	1	32
B.C.	20	28	12	3	63
Manitoba	2	3	3	0	8
N.B.	7	4	1	0	12
Nfld.	0	2	1	0	3
N.W.T.	0	3	1	0	4
N.S.	10	21	12	6	49
Ontario	15	19	19	5	58
P.E.I.	1	0	5	3	9
Quebec	13	5	2	1	21
Sask.	2	4	2	0	8
Yukon	12	1	0	0	13
Canada	97	92	72	19	280

Note: Column of stopped turbines does not include turbines in the column of turbines expected to run again.

* Owners could not be contacted or did not respond.

TURBINE RELIABILITY (Cont.)

Seventy-two of the 280 turbines detected in the survey are in operation. Seventy of the 72 operating machines account for a total of 601 kW of generating capacity. Capacity of the other two units is not known. Eight of the 70 running units have a generating capacity of between 20 and 70 kW and account for 395 kW and the remaining 62 turbines account for 206 kW. Eighteen of the 19 turbines, expected to run again, account for 231 kW of generating capacity and the capacity of the 19th unit is unknown. When the 19 turbines expected to operate again are returned to service, 88 machines will then account for a total of 832 kW. Including the 3 above-mentioned turbines of unknown capacity, 91 machines will be in operation. Table 7 provides a breakdown of the capacity of machines now in operation.

TABLE 7: Generating Capacity of Operational Turbines

Capacity	Number of machines
< 1 kW	18
1-10 kW	43
10-19 kW	2
20-70 kW	9
above 70 kW	0
Total	72

Thirty-eight survey respondents reported that operation of their turbines has been interrupted due to minor or major reliability problems. Table 9 in appendix 3 lists these problems by province, owner, turbine type and the reported problems.

Two of the problems can be largely attributed to a harsh environment. The 10 kW machine erected for TransAlta Utilities in Alberta operated at a site with turbulent and extremely powerful gusts. One or two of the 200-watt units, operated on Beaufort Sea icepacks by Esso, were blown over by gusts or damaged by a polar bear.

TURBINE RELIABILITY (Cont.)

Thirteen of the respondents reporting reliability problems also cited atmospheric turbulence at their turbine sites. Most owners who reported corrosion of components caused by moisture or salt erected their turbines at coastal or island sites.

Sixteen owners reported blade failures, main rotor shaft failures or bent blades. Seven of these owners installed Dunlite turbines and the rest installed individual turbines of different types. Five owners of Wincharger turbines reported that their generator brushes required replacement. Some of these owners were among the group that reported corrosion from moisture at their coastal or island sites.

Battery reliability problems were reported by 14 turbine owners. Their comments are contained in table 10 in appendix 3. Two owners indicated they had installed their batteries improperly, one saying this was due to a lack of proper advice on operation from the supplier. Two other owners reported minor corrosion or disintegration, and 2 more mentioned battery problems originating with their wind turbines.

7. LOCAL COMMUNITY IMPACT

One or two owners reported that the presence of their wind turbines was not liked by neighbours. Of the rest of survey respondents, some said this presence was enjoyed by neighbours, and many indicated the issue is irrelevent for them because they have no neighbours, or have none within a mile. No owners reported complaints made to government authorities but one owner on the tip of the Bruce Penninsula in Ontario said the local zoning authority influenced his selection of components, the tower and paint colors.

8. GOVERNMENT GRANT PROGRAMS

The survey detected 56 wind turbine owners who received a financial contribution from the federal or provincial government toward their projects. Most received a grant from one or more federal-provincial Conservation and Renewable Energy Demonstration Agreement (CREDA) programs which operated from 1980 until 1984.

CREDA contributed between 50% and 80% of project costs. Most CREDA grants ranged from $2,000 to $8,000. Most CREDA grants were awarded to owners in Nova Scotia. No CREDA grants were awarded to owners in Alberta.

One IRAP grant was awarded in Saskatchewan by the National Research Council and one Invention Innovation Program grant was awarded in Ontario.

Most survey respondents who received a grant reported being satisfied with it. A few did not say whether or not they were satisfied and eight said they were either not completely satisfied or simply dissatisfied. A provincial breakdown of the total number of grant recipients is contained in table 11 and comments from those who reported they were not satisfied, in table 12. Both tables can be found in appendix 3.

9. OWNER COMMENTS FOR OTHER TURBINE OWNERS

Thirty-one wind turbine owners provided comments and suggestions for other owners and for people interested in obtaining a wind turbine. Their comments appear in table 13 in appendix 3.

OWNER COMMENTS FOR OTHER TURBINE OWNERS (Cont.)

Nine comments are concerned with the wind resource at the owner's wind turbine site. A typical recommendation is to ensure there are adequate wind resources before considering purchasing of a wind turbine. Two owners suggested that an anemometer should be obtained. One of the two suggested a full year of wind measurement and the other suggested that a "wind-run" anemometer be used to identify the average wind speeds. One other suggestion among the nine comments concerning wind resources, was to find out at what height are wind speeds most constant.

Some of the comments imply that consideration should be made for the optimum location on the property that is available for installation of a wind turbine; for example, to avoid obstructions of the wind or to find topography that enhances the wind speed.

Many of the owners asked that potential owners carefully weigh the economics of adopting a wind turbine with other supply options -- whether these options be heating with wood, using solar power, introducing a power line, or contining to use existing service. Some also recommended that the buyer beware of unproven machines, and to carefully research the decision to obtain a turbine before buying. One owner said that potential owners should talk to an experienced wind turbine operator.

Other owners specified what type of turbine or application to select or avoid; high versus low-voltage electricity, or charging batteries verus water heating were mentioned. A few owners said a back-up gas generator should also be considered. A few other comments were provided on turbine operation, maintenance, safety, troubleshooting and modifications.

One government grant recipient, dissatisfied with his experience, advised potential owners to stay away from government.

10. OWNER COMMENTS FOR MANUFACTURERS AND SUPPLIERS

Thirty-eight wind turbine owners provided comments and suggestions directed at the turbine manufacturers and suppliers. These comments range from wind turbine design requirements to matters of operation and maintenance. They appear in table 14 in appendix 3.

Nine owners said suppliers should provide more complete information to customers and provide better after-sales advice. Some of these comments came in the form of complaints about inadequate cooperation or advice. Another owner suggested that a course on maintenance and repairs should be offered.

Two owners said the tower should be designed with maintenance in mind. One of the two owners specified a tilt-down tower.

Three owners wanted faster delivery of replacement parts or else recommended that the manufacturer's suppliers should carry a stock of such parts.

Several owners urged manufacturers to select reliable dealers to represent them. Others complained that the supplier of their turbines could not provide adequate advice on installation, operation and maintenance.

Three owners said they believed the price of their turbines was too high.

The design of wind turbines and various turbine components drew the greatest number of comments. Some simply recommended that the turbines should be of rugged design and construction. Others suggested modifying or redesigning specific components on specific turbines.

11. OWNER SUGGESTIONS TO GOVERNMENT

More wind turbine owners in the survey provided comments and suggestions about government than on any other topic. There were 43 comments about provincial and federal governments, and they are listed in table 15 in appendix 3.

Comments were made about the provision of support such as grants to encourage further wind turbine installations; removing sales taxes or providing tax credits for wind power investments; removing subsidies to competing energy sources such as utility electricity; further research to improve reliability and lower capital costs; and supporting efforts by small power producers to obtain better policies from the electric utilities.

One owner said he was not aware of the various grant programs when they were available from 1980 to 1985. Another owner asked that the grant program review boards use qualified, knowledgeable staff. Several owners asked that nuclear power not be used.

12. OWNER COMMENTS ABOUT ELECTRIC UTILITIES

Fifteen wind turbine owners provided comments about the electric utilities. Seventeen owners who responded to the survey installed grid-connected turbines and seven of them provided comments about the utilities.

Most of the comments were concerned with utility buy-back policies for grid-connected small power producers or about utility involvement in the owner's own wind project. These comments are contained in table 16 in appendix 3. Some of the utility interconnection policies are reported by turbine owners in table 17 in appendix 3.

As shown in table 17, 10 owners said the utility they connected with was not cooperative and 5 said the utility was cooperative.

13. CONCLUSIONS

Thanks to the responses, the history of one-half of the wind turbine installations in Canada is now known. This information obtained could be very useful to many wind turbine owners, manufacturers, suppliers, utilities and governments on a variety of technical, economic and regulatory topics.

Technical reliability appears to have been the major issue among the battery-charging turbines installed before 1984. Among the grid-connected turbines installed after 1883, technical issues appear to have been superceeded by institutional issues such as utility interconnection policies, energy subsidies and energy taxation.

APPENDIX 1

WORLD WIND COMMUNICATIONS CO.
44A Clarey Avenue
Ottawa, Ontario
K1S 2R7

CANADA

Tel. (613) 233-9732

December 5, 1986

Dear Friend,

I've begun a project to survey all wind turbines operating in Canada, with the support of the federal Department of Energy, Mines and Resources (EMR).

There are several hundred people across the country who own wind generators or wind pumps, or people who have owned one within the last few years. Their experience would be worth sharing with other owners, and with manufacturers and suppliers active in Canada today.

I have obtained your address either from a windmill supplier or, if your wind turbine went up with the help of a demonstration grant, from a federal or provincial energy department. I'd like your help in making this survey work.

Just to let you know who I am, starting five years ago I began writing about wind energy, first for a newspaper called Canadian Renewable Energy News (later just called R.E.N.). In 1984 I founded World Wind, an international newsletter on wind power development, and late last year, I took an additional job of publishing the Bulletin for the Canadian Wind Energy Association. The Association was formed by members of Canada's fledgling wind power industry in 1984.

You might not know it, but between two and three billion dollars has been invested in wind power projects around the world since 1980. The majority of these projects were built in California on "windfarms" to generate electricity for sale to the electric utilities.

At the beginning of this year, over thirteen thousand wind generators were in operation in California, together producing up to 1,120 megawatts. During 1985, these windfarms generated over 180 million kilowatt-hours. That's enough power for 30,000 homes each consuming 500 kilowatt-hours per month (California's average).

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After California, Denmark is the leading user of wind power to generate electricity. Compared to California, where nearly all of the projects are "windfarm" clusters of machines, Denmark has undergone a different kind of development.

Until the Danish began building windfarms a year ago, most of their wind generators -- over 1,000 of them -- have been serving individual farmers and homeowners or small groups of farmers and homeowners. What's more, an Association of Danish Windmill Owners was formed to represent these consumers to the suppliers, electric utilities (most are grid-connected machines) and local zoning authorities. The Association also helps the consumers keep track of important maintenance procedures and keeps track of how many kilowatt-hours the machines produce through the year. It even represents them before the insurance companies. Apparently the rates aren't bad, either.

Each new wind turbine that goes up benefits from experience with the previous one, because that experience is shared above-board and out in the open. Both the industry and the consumers benefit from this kind of arrangement.

Things are nowhere near as advanced in Canada, for one thing because most of the wind turbines here are battery bank-chargers often at remote locations. Canadian windmill consumers are spread across alot more territory than Danish or Californian consumers. Other countries where large wind power development is just starting include the Netherlands, Belgium, Greece, Italy, the U.K. and India. But let me return to the national windmill survey.

I am putting together a questionnaire to be sent to each wind turbine owner. It will ask questions in four areas;

-- The make and model (if purchased) or the dimensions and power output (if home-built) of your wind turbine, and the energy demand it serves (lights, fridge, etc.),

-- What the windmill site looks like, the known wind speeds and common wind direction.

-- The operational history of the wind system, its reliability and performance.

-- Your degree of satisfaction (or dissatisfaction) with the equipment and its' supplier.

I don't expect everyone will be able to answer each question perfectly. Most of the windmill owners may have no idea about what the actual average wind speeds are, except "strong", "not strong enough" or "too strong". Some may know if winds are rather

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turbulent at their windmill site. Otherwise, owners that don't know how many kilowatt-hours they're getting out of their turbines will still know whether they're getting enough power or not, for the appliances they operate.

Those of you who no longer own a machine because the system was not mechanically reliable enough may have the most important experiences of all. One example would be if the system lost a blade during an ice storm. It could indicate your region has an especially cruel climate for windmills, or it could indicate your windmill's design was not strong enough.

Others living nearby who consider putting up a system of their own would benefit from your knowledge, as would the manufacturer of the system, even if it means they don't put up a machine after all, because the windmill that doesn't go up in the first place is still a cheaper source of energy than the one that comes crashing down.

Many of you may own the same model of wind system. Maybe you have a problem getting spare parts. Maybe the manufacturer isn't in business anymore, but you want to keep using your machine. Perhaps one owner of a machine like yours has made a modification or added a new component that boosts the efficiency of the unit, or uses energy-efficient appliances that use less electricity in the first place.

After I've gathered as many survey responses as I can, the information will be compiled into a table listing all the details like type, size, load, installation date and present status. Accompanied by the responses of each owner, the information will be statistically analyzed (i.e., percent of owners satisfied with their systems) according to region, model, etc. After that, there will be room for recommendations from wind turbine owners to the windmill suppliers, if you care to make any. Those of you with grid-connected wind generators will also be able to make recommendations to the electric utilities if you wish.

I expect to have the questionnaire out to you in about a month's time. Meanwhile, feel free to call collect or write if you have any questions. In case you have never seen the CanWEA Bulletin I publish, I would be pleased to provide a copy.

I hope I can count on your participation. I think you will find it beneficial.

Kindest regards,

David Hoffman
Principal Investigator

WORLD WIND COMMUNICATIONS CO.
444 Clarey Avenue. Ottawa K1S 2R7, Canada. Tel. (613) 233-9732.

January 6. 1987.

Dear windmill owners.

Here is the survey questionaire I promised to send to you, and I hope you can take the time to fill it out today.

If you don't know the answer to some of the questions, write "don't know". When you don't even understand the question, use a "?" questionmark. And use a pencil, to easily erase mistakes.

Your answers will be used to prepare the project's final report. The report will contain the statistics (number of windmills, date installed, current operational status, etc.), an analysis of that statistical information. plus any important comments and suggestions made by the windmill owners.

One of the questions asks for your permission to include your name and address in the report but, if you don't want that, I don't have to use it. Otherwise, just your last name and your town, will be used to identify your machine from all the others.

After going through the survey, if there are questions you think I may have missed, please indicate this where your general comments are requested. Feel free to write all over the form, or use a separate sheet of paper (if so, please number your answers). If I need further information, I can call you.

A stamped, addressed envelope is included here for the completed form. There is enough postage there for three sheets of paper (this two-sheet form plus one additional sheet).

It is very important that you fill this out and send it back as quickly as possible because I have to start working on the final report within a few weeks.

I look forward to hearing from you soon.

Kindest regards,

David Hoffman
Principal investigator

NATIONAL WINDMILL SURVEY QUESTIONAIRE

Your name and province: _____

1. THE WINDMILL

1a. -did you buy the machine or make it yourself?

1b. -if bought, what's the brand name?

1c. -number of propellor blades?
1d. -propellor diameter in feet or meters?
1e. -propellor runs upwind or downwind of tower?
1f. -propellor kept facing the wind by tailvane?

1g. -rated power output in watts or kilowatts?
1h. -wind speed when output is at rated power?
1j. -windmill uses rectified AC alternator, AC induction, AC synchronous or DC generator?

1k. -windmill voltage (12, 24, 36, 110, more, volts AC or DC)?

1m. -height of the windmill tower in feet or meters?
1n. -tower supported by guy wires or not?
1p. -tower is radio mast, tubular metal or truss type?

1q. -if bought, did you buy it direct from manufacturer or through local supplier?
1r. -name of local supplier?

2. THE WIND POWER APPLICATION

2a. -does the windmill only generate electricity?

2b. -is power stored in batteries and/or fed into the utility grid?

2c. -is there electric utility service available at the windmill site?

2d. -does the windmill serve a home, cottage, office, commercial, government or industrial site?

2e. -if a home, office or cottage, does the windmill provide energy used in lighting, small and/or large appliances (electric motors, stove heating elements, water heater, refridgerator)? (circle one or more)

2f. -if not, is application remote telecom, navagational aids or other?

2g. -can you list power demand in watts or kilowatts of each appliance or each load?

3. PERFORMANCE OF THE WINDMILL

3a. -when operating reliably, does the windmill meet the energy demand satisfactory?

3b. -does the windmill's power output vary little or greatly through the seasons?

3c. -does that variation affect your power consumption habits?

4. RELIABILITY OF THE WINDMILL

4a. -who erected the windmill (you, friends and/or a supplier)?

4b. -was installation done properly?

4c. -when did the windmill start operating (month, year)?

4d. -is it still in operation?

4e. -was operation ever interrupted and if so, why?

4f. -if no longer in operation, when and why did it stop?

4g. -if so, do you plan to operate it again?

4h. -what kind of maintenence is done, and how often?

4k. -who is supposed to do that maintenance--you or the supplier?

4m. -has ice from freezing rain ever built up on the windmill?

4n. -if so, did it affect the windmill's operation?

4p. -what about hail stones?

4q. -do you think the winds at your site are fairly smooth or too turbulent and rough for your windmill (or for any windmill)?

5. THE ELECTRIC UTILITY

5a. -if the windmill is grid-connected, who is the utility company?

5b. -will they buy back your power or let you "bank" kilowatt-hours?

5c. -if they buy it, what do they pay you (cents per kWh)?

5d. -what do they charge you for their power that you consume?

5e. -was the utility co-operative to your project?

5f. -do you have any comments or suggestions about the utility regarding your windmill?

6. IMPACT ON COMMUNITY

6a. -do any neighbors like or dislike the presence of your windmill?

6b. -have any complained to you or to government about its visual presence or any perceived possible danger?

7. ENERGY STORAGE

7a. -if power is stored in batteries, ever have problems relating to the batteries?

7b. -do you divert excess power to, say, space or water heater?

8. OTHER QUESTIONS

8a. -did you get a government grant helping you put up the windmill?

8b. -if so, can you name the program?

8c. -if so, are you satisfied or not with the program's support for your project?

8d. -do you want a copy of the completed final report of this project or a summary of its' findings?

8e. -do you want to have your name and address added to a large list for windmill owners to contact and meet each other?

8f. -do you have any suggestions for the manufacturer or supplier of your windmill?

8g. -any suggestions for the provincial or federal government?

8h. -do you have suggestions for other windmill owners?

8j. -is your windmill site on top of a hill or a mountain, in a valley, among low rolling hills, on a flat plain, in a forest area or not?

PLEASE RETURN THIS FORM (OR A SEPARATE SHEET) AS SOON AS POSSIBLE USING THE STAMPED, ADDRESSED ENVELOPE!

APPENDIX 2

KEY TO TABLE 8

Introduction

Wind turbines are listed in table 1 alphabetically by province and then by the owner's name. Some of the owner's names are companies or otherwise not individual people. Acronyms of those names are used to facilitate space limitations.

The location of each turbine provided in table 1 is typically the nearest town or locally-known topographical feature, such as "Pink Mtn." (mountain), "Lasqueti I." (island) etc., or otherwise the name of the county, such as "Cape Breton".

The type of turbine and it's generating capacity is indicated next. "D-2kW" is a Dunlite model generating two kilowatts at rated output, and "W-200W" is a Winco Wincharger model rated at 200 watts. A list of the symbol letter used for each type of turbine is contained in the list appearing on page 32 after the one below.

Tower type and height, the year the turbine was installed, the role it serves, the present operational status or year of decommissioning, a note on the installation, and the wind conditions and topography of the site, are indicated respectively in table 1 in the further columns in table 1. The particular symbols used in each column are explained here.

TERM	MEANING
Ba	BATTERY ELECTRICITY STORAGE (BaCo-COMMERCIAL) (BaFa-FARM) (BaIn-INSTITUTION) (BaNA-NAVIGATIONAL AID) (BaRe-RESIDENCE) (BaTC-TELECOMMUNICATIONS)
CiGr	GREENHOUSE WATER CIRCULATION
Gr	UTILITY GRID-CONNECTED (GrCo-COMMERCIAL) (GrFa-FARM) (GaIn-INSTITUTION) (GrRe-RESIDENCE)
He	ELECTRIC-HEATED THERMAL STORAGE (HeCo-COMMERCIAL) (HeRe-RESIDENCE)
H/T	TOWER HEIGHT (IN FEET) AND TYPE (MG-Tubular metal, Guyed) (PG-Power or telephone pole, Guyed) (RG-Radio mast, Guyed) (TG-Truss, Guyed) (W-Live tree)
IrFa	FARM FIELD IRRIGATION
NOTE	COMMENTS ON INSTALLATION
ROLE	SYSTEM APPLICATION (Ba, Ci, Gr, He, Irri)
ST	YEAR SYSTEM STOPPED OPERATING (- hyphen -STILL RUNNING)
TO	PRESENTLY NOT RUNNING, BUT INTEND TO AGAIN
TYPE	TURBINE MANUFACTURER AND POWER CAPACITY
UP	YEAR SYSTEM INSTALLED

W/S WIND RESOURCE.... (F-Strong) (G-Good)
(H-Hail) (I-Ice buildup)
(N-Not enough) (S-Smooth)
(T-Turbulent) (V-Seasonal variations)
.....AND SITE TYPE AND TOPOGRAPHY (F-Forest area) (H-Hill)
(I-Island) (LH-Low rolling hills)
(M-Mountain) (P-Flat plain)
(S-Shoreline) (V-Valley)

CODES USED IN TABLE 1 TO INDICATE TURBINE TYPE

CODE	COMPANY	COUNTRY
A	AEROLITE *	USA
AG	ANDREWS, Brian	CANADA
B	BERGEY WIND POWER CO.	USA
C	AEROWATT S/A.	FRANCE
BO	BONUS WIND TURBINES	DENMARK
CE	CANERGY *	CANADA
D	DUNLITE POWER CO.	AUSTRALIA
DE	DEMPSTER	USA
E	ENERTECH CORP.	USA
F	ELEKTRO GMBH.	SWITZERLAND
G	HELIOWATT INC. **	CANADA
H	HUMMINGBIRD POWER CO.	USA
HB	Home-built unit	CANADA
HO	JAMES HOWDEN CO.	UK
J	JACOBS WIND ELECTRIC CO.	USA
K	HELI-O-BEAUCE	CANADA
L	EXTRAWATT **	CANADA
N	NORTH WIND POWER CO.	USA
NO	NORDTANK A/S	DENMARK
PD	PRODUCT DEVELOP. INST.	USA
Q	W.T.G. ENERGY SYSTEMS	USA
R	WINDWORKS*	USA
S	SENCENBAUGH	USA
SD	SD SYSTEMS *	CANADA
T	THERMAX ENERGY CORP.	CANADA
TR	TRIGON CO.	CANADA
V	WHIRLWIND POWER CO.	USA
W	WINCO	USA
WP	Water-pumping windmill	
WTG	Unknown type	
Y	WELLINGTON WINDPOWER CO.	CANADA
Z	WINFLO POWER CO. *	CANADA

*--No longer in business.
**--Replaced by Heli-O-Beauce in 1986.

TABLE 8: Main listing of wind turbine data

MAIN DATA TABLE

ALBERTA

OWNER	LOCATION	TYPE	H/T	UP	ROLE	ST	NOTE	W/S
ATWOOD	CARDSTON.	E-5kW		85	GrRe	-		
CARDSTON	CARDSTON,	E-60kW		86	GrIn	-		
SCHOOL,	CARDSTON,	E-60kW		86	GrIn	-		
C.B.C.,	PIDGEON MT.,	N-2kW	TG	83	BaTC	-		T/M
CDN.W.N.G.,	PLATEAU MT.,	N-2kW		80	BaTC	-		
EDWORTHY,	CALGARY,	W-1.2kW		80	BaRe	83	++	VIG/LH
		W-1.5kW		84	BaRe	-		VIG/LH
		E-1.8kW	PG-65	83	GrRe	-		VIG/LH
ESSO,	BEAUFORT SEA,	W-200W	MG-12	72	BaTC	77	*	VI/LHP
		W-200W	MG-12	72	BaTC	77	*	VI/LHP
		W-200W	MG-12	72	BaTC	77	*	VI/LHP
		W-200W	MG-12	72	BaTC	77	*	VI/LHP
		W-200W	MG-12	72	BaTC	77	*	VI/LHP
		W-200W	MG-12	73	BaTC	77	*	VI/LHP
		W-200W	MG-12	73	BaTC	77	*	VI/LHP
		W-200W	MG-12	73	BaTC	77	*	VI/LHP
		W-200W	MG-12	73	BaTC	77	*	VI/LHP
		W-200W	MG-12	73	BaTC	77	*	VI/LHP
		W-200W	MG-12	73	BaTC	77	*	VI/LHP
ESSO,	N. ALBERTA,	W-450W		85	BaTC	-		
	N. ALBERTA,	T-200W		85	BaTC	-		
HARGREAVES,	WALSH,	E-25kW		85	GrFa	-		
HARROWING,	WINFIELD,	D-2kW	T-50	80	BaRe	81	#	VSN/V
LETH,	TABER,	NO-65kW	M-72	86	GrFa	-		S/P
MCGEE,	NANTON,	J-1.8kW		?	?	?		
NOVA CORP.,	ENCHANT,	D-5kW	T-70	81	BaTC	?	**	
SCHAUERTE,	PINCHER CR.,	E-5kW		84	GrRe	-		
SINNOT,	PINCHER CR.,	E-40kW	T-80	84	GrFa	-		TG/P
SUNCOR CO.,	CALGARY,	HB-100W		75	BaTC	76	*	
		HB-100W		75	BaTC	76	*	
		HB-100W		75	BaTC	76	*	
		HB-100W		75	BaTC	76	*	
		HB-100W		75	BaTC	76	*	
		HB-100W		75	BaTC	76	*	
		HB-100W		75	BaTC	76	*	
		HB-100W		75	BaTC	76	*	
		HB-100W		75	BaTC	76	*	
		HB-100W		75	BaTC	76	*	
		HB-100W		75	BaTC	76	*	
		HB-100W		75	BaTC	76	*	
TATRO,	TROCHU,	B-1kW	T-40	85	BaRe	-		S/H

ALBERTA continued

OWNER	LOCATION	TYPE	H/T	UP	ROLE	ST	NOTE	W/S
TRANSALTA,	CHRISTIE RG.,	B-10kW	MG-80	84	BaTC	86	+	T/M
WHITE,	WINFIELD.	W-1.5kW	T-55	78	BaRe	TO		VN/H

NOTES ON ALBERTA INSTALLATIONS:
*---Used in temporary application, then dismantled.
**--Broken tail vane repaired twice, still running 10/85.
+---Four mech. failures, dismantled, repl. by trans. line.
#---Batteries unreliable, replaced by grid.
++--Dismantled for other purposes, replaced by new machine.

BRITISH COLUMBIA

OWNER	LOCATION	TYPE	H/T	UP	ROLE	ST	NOTE	W/S
ANDERSON,	LASQUETI I.,	W-200W	W-100	76	BaRe	-		VT/HF
		J-2kW	T-96	81	BaRe	-		
ANDRE,	DAYMAN I.,	CE-3.5kW		<80	?	?		
ANTE,	COURTENAY,	CE-500W		<80	BaRe	?		
BARRETT,	LASQUETI I.,	W-200W	W-100	87	BaRe	-		/H
B.C. TEL,	KLEMTU,	D-2kW	MG-50	83	BaTC	84	((	VITH/M
	KLEMTU,	D-2kW	MG-50	83	BaTC	84	((	VITH/M
	KLEMTU,	V-2kW	MG-	85	BaTC	86	((	VITH/M
	KLEMTU,	N-3kW	MG-70	86	BaTC	86	((	VITH/M
	CALVERT I.,	N-3kW	MG-70	85	BaTC	-		VITH/M
BLOCK,	FRASER LAKE,	L-2kW		80	BaRe	?		VITH/M
BOUDICH,	Q. CHARL. I.,	WTG		80	?	?	)	
BRAITH-WAITE,	FT. ST. JOHN,	D-2kW	T-40	80	BaRe	81	()	N/H
BUTLER,	UCLUEOET,	W-200W		79	BaRe	?	)	
CDN. C.G.,	SHARP PT.,	D-2kW		74	BaNA	<86	%	T/SLH
	LOOKOUT PT.,	D-2kW		<80	BaNA	<86	%	T/SLH
	GODKIN PT.,	D-2kW		75	BaNA	<86	%	T/SLH
	HADDINGTON R.,	D-2kW		74	BaNA	<86	%	T/SLH
	NAHWITTI PT.,	D-2kW		<80	BaNA	<86	%	T/SLH
	N.E. PT.,	D-1kW		<80	BaNA	<86	%	T/SLH
	REBECCA ROCK,	D-1kW		<80	BaNA	<86	%	T/SLH
	PORTLOCK PT.,	D-1kW		70	BaNA	-	&	T/S
	ROBERTS BANK,	D-2kW		78	BaNA	-	&	T/S
	JEANETTE I..	D-1kW		<80	BaNA	<86	%	T/I
CDN. C.G.,	PR. RUPERT,	CE-500W	MG-21	80	BaNA	81	++	VI/I
		N-3kW	T-40	86	BaNA	-		V/I
CHADWICK,	PAVILLION L.,	CE-500W		<80	BaRe	?		
CHURCHILL,	LASQUETI I.,	W-650W	W-65	80	BaRe	-		VS/H
CRINGAN,	DOME CREEK,	D-2kW		80	BaRe	?		
CULP,	DUNSTER,	D-2kW		77	BaRe	<86	(	
DUCHASTEL,	DUNSTER,	W-200W		77	BaRe	?		
GARDINER,	100 MI. HOUSE,	CE-3.5kW		<80	?	?		
GRAHAM,	LASQUETI I.,	W-200W		79	BaRe	?		
HADLAND,	CECIL LAKE,	D-5kW	T-60	84	GrRe	TO	+	/LH
HAMILTON,	LASQUETI I.,	W-200W	PG-10	77	BaRe	82	(	VS/S
HANDEL,	ISKUT LAKE,	HB-1kW	T-30	70	BaRe	80	))	VF/VF
HANNA,	PR. RUPERT,	HB		<81	?	?	)	
HARRISON,	GABRIOLA I.,	W-200W	T-30	79	BaRe	?		/S
HAUPEDAL,	LASQUETI I.,	WTG		<87	BaRe	?		
HEATH-RINTON,	LASQUETI I.,	D-2kW		80	BaRe	?	)	
HOWARD,	DUNSTER,	D-2kW	T-50	76	BaRe	-	&	VS/HFV
IMMEGA,	LASQUETI I..	D-2kW		80	BaRe	?		
JACOB,	POWELL R.,	D-5kW		80	?	?	)	
JUNGEN,	MCBRIDE,	D-2kW	M-35	78	BaRe	84	(	/V

BRITISH COLUMBIA continued

OWNER	LOCATION	TYPE	H/T	UP	ROLE	ST	NOTE	W/S
KURLAND,	LASQUETI I.,	WTG		<87	BaRe	?		
LIN-	LASQUETI I.,	D-2kW		79	BaRe	?		
SHOETEN,								
MALLARD,	VICTORIA,	WTG		79	?	?		
MITCHELL	KAMLOOPS,	D-2kW		75	BaRe	?		
MONAHAN,	LASQUETI I.,	W-200W		77	BaRe	?		
MORREL,	KEATS ISL.,	D-2kW		80	BaRe	?		
MOUNTAIN,	ROBERTS CR.,	E-1.5kW		80	GrRe	?	)	
NICHOLL,	WHALETOWN,	D-2kW	T-60	77	BaRe	?		VS/HLF
		D-5kW		80	BaRe	TO		VS/HLF
OSTROM,	PR. RUPERT,	W-200W		79	BaRe	?		
SLOANE,	LASQUETI I.,	D-2kW		80	BaRe	?		
SWETS, C,	DUNSTER.	D-2kW	T-50	87	BaRe	-		VN/H
SWETS, J,	DUNSTER,	D-2kW		74	BaRe	-		
SYRYDA,	FT. ST. JOHN,	V-4kW	M-93	87	GrRe	-		
TRASK,	PINK MTN.,	D-2kW	T-40	79	BaRe	82	((	VT/VH
WARNER,	SAVORY ISL.,	W-200W	W-30	80	BaRe	TO		VS/I
WHEELER,	LASQUETI I.,	F-6kW	RG-60	75	BaRe	85	**	G/HIF
WILLEY,	LILLOET,	W-200W		79	BaRe	?		
WINDEMUFE,	GALIANO I.,	W-200W		79	BaRe	?	)	

NOTES ON BRITISH COLUMBIA UNITS:
&--Still used in September 1986. ()-Not used, not enough wind.
#--Still standing but not used in Sept. 1986. +--CREDA-funded.
++--Destroyed in storm. (--Sold.))--Site dismantled.
((--Damaged in storm. %--Replaced by PV.)--Owner moved.
**--Mechanical problems, sold to neighbors.

MANITOBA

OWNER	LOCATION	TYPE	H/T	UP	ROLE	ST	NOTE	W/S
BOEHEM,	WINNIPEG,	B-1kW	-90	83	BaRe	?	+&	
CARRIERE,	STE. ANNE,	E-4kW	RG-60	83	GrRe	-	&	VSI/PF
DEKKER,	STEINBACH,	HB-40W	TG-50	83	BaRe	<86	*&	IT/PF
		HB-400W		82	BaRe	-		IT/PF
ERICKSON,	CHURCHILL,	H-8kW	-42	83	HeGr	?	*&	VSI/H
KLYM,	STE. ANNE,	E-4kW	TG-60	83	GrRe	-	&	SH/P
REYNOLDS,	KILLARNEY,	PD-8kW,	-50	83	GrFa	?	&	
WILDON CO.,	GIMLI,	HB-WP	-40	83	IrFa	<86	*&	

NOTES ON MANITOBA UNITS:
*--Reported 6/86 not operating. +--Reported 6/86 operating.
&--Funded by CREDA. ++--Damaged by hail stones.

NEW BRUNSWICK

OWNER	LOCATION	TYPE	H/T	UP	ROLE	ST	NOTE	W/S
BETTS,	DEAKTOWN,	D-2kW		<87	BaRe	?		
C.B.C.,	SACKVILLE,	D-2kW	RG-10	77	BaTC	78	&	IS/P
		Z-500W	RG-10	77	BaTC	<80	&	IS/P
C.C.G.,	CAPE SPENCER,	N-2kW		81	BaNA	?		
CLIFFORD,	ST. MAURE,	Y-1.5kW	-30	83	BaRe	?		
FARRELL,	CATERBURY,	X-3kW	PG-50	83	GrRe	?	*	/M
GIONET,	CARAQUET,	G-7kW	MG-54	83	HeRe	83	*&++	VT/F
N.B. POWER,	SACKVILLE,	S-750W	RG-20	76	BaCo	<81	&	VN/H
	SHEDIAC,	D-2kW	T-50	78	BaCo	81	(	G/P
N.B. TOURISM,	MT. CARLETON,	D-2kW	T-40	77	BaTC	<84	&	ITF/M
NOEL,	TRACADIE,	E-1.8k	GM-60	83	GrRe	-	*	VS/P
ROBICHAUD,	MONCTON,	HB-4.5kW	MG-65	84	HeRe	85	&*	IT/LH

NOTES ON NEW BRUNSWICK UNITS:
*--CREDA-funded. &--Dismantled due to mechanical failures.
++--Operated for 1 month.

NEWFOUNDLAND

OWNER	LOCATION	TYPE	H/T	UP	ROLE	ST	NOTE	W/S
DUFFY,	AGUATHUNA,	E-1.8kW	TG-30	83	GrRe	-	+	VIG/LH
KING,	MT. PEARLE,	W-450W	PG-	83	BaRe	?	+	
NFLD. TEL.,	ST. JOHN'S,	N-2kW		<84	BaTC	?	*	

NOTES ON NEWFOUNDLAND UNITS:
+--CREDA-funded.
*--Installed on Cycle-Charge experiment site, owned by supplier.

NORTHWEST TERRITORIES

OWNER	LOCATION	TYPE	H/T	UP	ROLE	ST	NOTE	W/S
BRANDT,	YELLOWKNIFE,	Y-3kW		82	BaRe	?	+)	
C.C.G.,	GRIFFITH I.,	C-4kW	MG-55	85	BaNA	-		TI/IM
F. ROSS CO.,	CAMBRIDGE BAY,	J-17.5kW		83	GrCo	?	+(	
		J-17.5kW		85	HeRe	?	(	

NOTES ON N.W.T. UNITS:
+--CREDA-funded.)--Owner moved.
(--Reported 1/87 not operating.

NOVA SCOTIA

OWNER	LOCATION	TYPE	H/T	UP	ROLE	ST	NOTE	W/S
AIKEN,	TATAMA-GOUCHE,	HB-100W	MG-45	78	BaRe	<85	&#*	VIT/F
		HB-		?	BaRe	-		
ASHBY,	HALBOU,	WTG		81	?	?	&)	
BEDFORD I.,	HALIFAX,	C-30W	T-33	76	BaTC	78	**	S/S
BEDFORD INSTITUTE,	HALIFAX,	C-30W	T-33	76	BaTC	78	**	S/S
		C-30W	T-33	77	BaTC	78	**	S/S
BIRCH,	MARION BR.,	D-2kW		81	GrRe	TO	&#	
BOSWORTH,	HANTSPORT,	A-10kW	-80	83	GrRe	?	&	
BROOKS,	C. BRETON,	V-2kW		84	?	?		
BROWNING,	WOLFVILLE,	W-1.2kW	TG-62	81	BaRe	-	&	VTI/HF
BUNNELL,	N. GERMANY,	D-2kW	-50	81	?	?	&	
		D-5kW	-120	82	BaRe	?	&	
CLARK,	ANTIGONISH,	V-2kW	MG-60	82	BaRe	84	&*	FIH/H
DAIGNEAULT,	DINGWALL,	HB-		82	?	?	&	
DARTMOUTH SCHOOL,	DARTMOUTH,	W-1kW		80	BaIn	?	&	
GALLEY,	HANSPORT,	SD-2kW	RG-30	81	BaRe	81	&+#	G/H
GOURD,	EUREKA,	W-200W	PG-50	74	BaRe	TO		VIS/H
		W-450W	-50	84	BaRe	-	&	VIS/H
		W-450W	-50	84	BaRe	-	&	VIS/H
		W-450W	-50	84	BaRe	-	&	VIS/H
		W-450W	-50	84	BaRe	-	&	VIS/H
		W-450W	-50	84	BaRe	-	&	VIS/H
		W-450W	-50	84	BaRe	-	&	VIS/H
HANNAH,	ROSEBUD,	WTG-1.2kW		82	?	?	&	
HARDING,	SABLE R.,	T-25W		82	BaRe	82	&#	
HARDY,	ANTIGONISH,	WTG		81	?	?	&	
HATT,	BRIDGEWATER,	WTG		82	HeRe	?	&	
HENDERSON,	BADDECK,	D-2kW	P-60	82	BaRe	-	&	VSI/H
HUSS,	CALEDONIA,	J-1.8kW	T-55	82	BaRe	<86	&	
JENKINS,	SEABRIGHT,	WTG		83	?	?		
KADLEC,	HALIFAX,	K-8kW		86	HeRe	-		
KRAUSSE,	BEDFORD,	E-1.8kW	TG-60	82	GrCo	-	&	IT/F
LAMBERT,	LAKE CHARLOTTE,	WTG		81	HeRe	?		
LIBBEY,	SYDNEY,	HB-25W	M-18	81	BaRe	TO	&	IG/LH
		HB-30W	M-18	75	BaRe	<86		
LIVINGSTON,	LAKE CHARLOTTE,	D-2kW	-40	80	BaRe	?	&	
		D-2kW	-40	80	BaRe	?	&	
MACKEY,	SYDNEY,	E-1.8kW	MG-70	82	GrRe	TO	&	SI/H
MACKENZIE,	BRAS D'OR,	HB-1kW		80	HeRe	?	&#	
MACLEOD,	MARION BR.,	WTG-3kW		82	?	?	&	

NOVA SCOTIA continued

OWNER	LOCATION	TYPE	H/T	UP	ROLE	ST	NOTE	W/S
MIRA PASTURE,	SYDNEY,	WTG		81	?	?		
NANGERONI,	DIGBY,	HB-		80	HeRe	?	&)	
N.S. POWER,	WRECK COVE,	Q-200kW	T-120	79	GrCo	TO		IS/H
OICKLE,	N. GERMANY,	HB-5kW	-50	81	BaRe	?	&	
POST,	WEST RIVER STATION,	WP-DE	T-35	82	CiGr	-	&	S/LH
ROBICHAUD,	METEGHAN R.,	HB-		81	?	?		
ROGERS,	SABLE R.,	B-1kW	TG-60	85	GrRe	TO	&	/S
SMITH,	CHESTER BASIN,	E-1.8kW	PG-60	83	GrRe	85	&%	VIS/H
THIEBAUX,	HALIFAX,	WTG		80	?	?	)	
VAN ZUTPHEN,	LIVERPOOL,	S-1kW	TG-100	84	BaRe	-	&	VIS/FLH
ZIMMERMAN,	GREAT I.,	J-1.8kW	R-60	85	BaRe	-		V/S

NOTES ON NOVA SCOTIA UNITS:
*--Sold before 1985. +--Rebuilt as 500W unit. &--CREDA-funded.
#--Damaged before 1985. %--Damaged.)-Owner moved.
**--Site temporary, dismantled.

ONTARIO

(Not including Ottawa region)

OWNER	LOCATION	TYPE	H/T	UP	ROLE	ST	NOTE	W/S
BALL	WELLINGTON,	Y-5kW	T-60	77	BaCo	-		VTI/P
		Y-10kW	T-60	77	BaCo	-		VTI/P
BEATTY,	LONDON,	HB-		<86	?	?		
BOWLES,	BARRYS BAY,	Y-3kW		81	BaRe	?		
BROSIC,	ACTON,	HB-		80	?	?		
C.C.G.,	CARDINAL,	C-26W	M-30	75	BaNA	78	(	VN/P
		TR-30W	M-30	80	BaNA	82	(	VN/P
C.C.G.,	PARRY SOUND,	C-30W		79	BaNA	82	*	S/SF
	GEORGIAN B.,	D-2kW		70	BaNA	79	**	S/SF
DOMBROS-KIE,	CAMBRIDGE,	T-25W		81	BaRe	?	)	
FULLMER,	KENORA,	J-2kW		77	BaRe	?		
GOLBECK,	TIVERTON,	WTG-300W		<87	BaRe	?		
INTERNAT.	MARKHAM,	C-30W		72	?	?	)	
AERADIO,		C-30W		72	?	?	)	
		C-30W		73	?	?	)	
KORTRIGHT CENTRE,	DOWNSVIEW,	Y-10.5kW		83	BaIn	-		
MCKINNON,	THUNDER B.,	T-100W	MG-10	83	BaRe	-		/I
MCQUAIL,	LUCKNOW,	CE-2kW	MG-30	80	GrRe	80		VT/H
		E-1.8kW	PG-45	83	GrRe	TO		VT/H
MIRON,	NEW LISKARD,	Y-5kW		<87	?	?		
ON. HYDRO,	FT. SEVERN,	HO-60kW		87	GrCo	-		
ON. M.N.R.,	WINISK,	B-10kW		84	BaIn	-		
PARKER,	BRYNSTON,	Y-5kW	-40	85	BaRe	-		VIS/P
PLOWRIGHT,	BARRYS BAY,	V-2kW		83	BaRe	83	++	VIT/LH
		Y-1kW		83	BaRe	84	&	VIT/LH
		Y-8kW	MG-60	85	BaRe	-		VIT/LH
POLIVKA,	KINGSTON,	HB-6kW		77	HeCo	<86	)	
ROSE,	WAINFLEET,	J-1.8kW		80	GrRe	84	)	
SHORE,	SUTTON,	Y-3kW	MG-40	86	HeRe	-		VS/LH
TOWSLEY,	BLENHEIM,	D-2kW	-65	77	BaRe	TO		VS/H
TRATNEN,	BELLE FONTAINE,	HB-1kW	T-50	86	HeCo	-		VI/LH
TRENT U.,	PETERBOROUGH,	Y-5kW		<85	BaIn	86	+	
TWIN VALLEYS,	WARDSVILLE,	F-2.2kW		78	BaIn	<86	)	
		HB-300W		81	BaIn	<86	)	
UMANETZ,	HANOVER,	W-1kW	MG-45	77	BaRe	?		/V
		J-2kW	T-80	<86	BaRe	?		/V
WATSON,	REXDALE,	HB-500W	T-40	85	BaCo	-		V/LH
WEBBER,	ORILLIA,	Z-500W	T-57	77	BaRe	77	++	
WESSELING,	TOBER MORY,	Y-3kW	MG-65	84	BaRe	-		VTI/S

ONTARIO continued

OWNER	LOCATION	TYPE	H/T	UP	ROLE	ST	NOTE	W/S
WINTER,	REABORO,	Y-5kW	T-40	87	BaRe	-	+	/H

NOTES ON ONTARIO UNITS:
*--Replaced by grid power in '82. ++--Destroyed in 3 months.
**--Shipped to CCG in B.C. in '79, repl. by grid.
+--Bought used from/sold by U. Trent, 1986.)--Owner moved.
(--Site dismantled. ()--Never worked. &--Damaged by storm.

OTTAWA REGION

OWNER	LOCATION	TYPE	H/T	UP	ROLE	ST	NOTE	W/S
BADOR,	LANARK,	HB-		85	?	?		
COM. RSCH.	SHIRLEY	T-100W		<85	BaTC	-		
CENTRE,	BAY,	AG-18W		79	BaTC	-		
		AG-30W		86	BaTC	-		
COURTNEY,	MABERLY,	J-3kW	TG-100	80	BaRe	-		S/LH
GRAY,	OTTAWA,	HB-200W		83	BaRe	?		
GENREP	NEPEAN,	W-200W		82	BaCo	85	)	
KERR,	DALKEITH,	T-25W		80	BaRe	?	*	
KIDD,	MABERLY,	Y-1.2kW	T-65	83	BaRe	-		VN/LHS
LEGREE,	CALABOGIE,	HB-		84	?	?		
MCKENDRIE,	OTTAWA,	T-100W		83	BaRe	?		
PREJELJ,	CARP.,	T-25W		80	BaRe	?		
SMITH,	PICTON,	Y-20kW	MG-42	84	HeRe	-		N/H
SNEFJELLA,	BANCROFT,	HB-300W	PG-30	84	BaRe	TO		VIS/H
		T-100W	PG-30	85	BaRe	TO	+	VIS/H
STEEVES,	MABERLY,	J-1.8kW	TG-71	79	BaRe	81	++	VT/F
TRANSPORT CANADA,	CARP,	N-2kW	RG-50	84	BaNA	TO		VS/P
VOGT,	KINBURN,	HB-		86	?	?		

NOTES ON OTTAWA REGION UNITS:
* Damaged in 1983. ++--Poor site winds.)--Owner moved.
+--Dismantled after several brush replacements.

PRINCE EDWARD ISLAND

OWNER	LOCATION	TYPE	H/T	UP	ROLE	ST	NOTE	W/S
BROWN,	BUNBURY,	B-1kW	PG-65	81	GrRe	-		G/P
CRAWFORD,	CHERRY HILL,	HB-3kW	M-36	84	HeRe	-	++	G/H
GARNUM,	CH'TOWN,	HB-500W	T-30	70	BaRe	84	&	VIS/P
HOWATT,	BEDEQUE,	B-1kW	-75	83	HeRe	TO	+	IG/P
NEWMAN,	NEW HAVEN,	J-2.8kW	T-45	75	BaRe	TO	+	IH/LH
P.E.I. ENERGY CORP,	CH'TOWN,	E-40kW	T-80	84	GrCo	-	*	VS/SP
WESTISLE SCHOOL,	ELMSDALE,	E-1.8kW		79	GrIn	-	**	
WOOTTON,	CH'TOWN,	B-1kW	PG-50	83	BaRe	-		S/SP
		T-100W	PG-35	85	BaRe	TO	+	S/S

NOTES ON P.E.I. UNITS:
*--CREDA-funded. &--Sold. ++--Generator not mounted yet 1/87.
**--Sporatic operation, roof-mounted, to be dismantled in '87.
+--To be repaired, needs parts.

QUEBEC

OWNER	LOCATION	TYPE	H/T	UP	ROLE	ST	NOTE	W/S
ANDRE PIERRE RADIO,	L. MEGANTIC,	L-11kW		82	BaCo	?		
ANCTIL,	LEVIS,	HB-6kW		<84	?	?		
BOILY,	ALMA,	HB-		<84	?	?	)	
BOUCHARD,	MAGDELEN I.,	K-8kW		86	GrCo	-		
C.C.G.,	QUEBEC CITY,	D-2kW		78	BaNA	80	++	
C.C.G.,	R. DU LOUP,	D-2kW		73	BaNA	85	+	
CLOUTIER,	LA PETRIE,	L-8kW		83	HeRe	85	&&	
GAGMON,		WTG		<86	?	?		
HYDRO QUEBEC	BALEINE	C-150W	MG-28	81	BaTC	82	(	S/H
	RIVER,	C-150W	MG-28	81	BaTC	82	(	S/H
		C-150W	MG-28	82	BaTC	82	(	S/H
		C-150W	MG-28	82	BaTC	82	(	S/H
		C-150W	MG-28	82	BaTC	82	(	S/H
		C-1.1kW	MG-28	82	BaTC	82	(	S/H
HYDRO-QUEBEC,	KUUJJUAQ,	BO-65kW		86	GrCo	-	**	
MARCOTTE,	QUEBEC CITY,	L-8kW	MG-30	84	HeRe	85	&	VIT/P
OUELLETTE,	ST-LOUIS DE HA HA!,	K-25kW		85	BaIn	?	*	

QUEBEC continued

OWNER	LOCATION	TYPE	H/T	UP	ROLE	ST	NOTE	W/S
QUE. MIN. TOURISM,	MONTREAL,	WTG		<86	?	<86		
SMILLE,	WEEDON,	J-2kW	TG-50	80	BaRe	<86	(	G/H
UNIV. LAVAL	LAUZON PARK,	C-4kW	MG-	78	GrIn	TO		VIT/LH
VACEK,	ETANG-DU-NORD,	HB-		82	?	<86	)	

NOTES ON QUEBEC UNITS:
*--ENERDEMO Canada-funded. **--RCDP Canada-funded.
&--Sold to Mr. Cloutier in La Petrie.)--Owner moved.
+--Dismantled, worn parts unavailable. (--Site dismantled.
++--Dismantled, corrosion at shore site.
&&--Mechan. problems, low site wind speeds, dismantled, sold.

SASKATCHEWAN

OWNER	LOCATION	TYPE	H/T	UP	ROLE	ST	NOTE	W/S
BECHARD,	LAJORD,	HB-15kW		80	?	?		
CANAEROTECH,	PIKE LAKE,	HB-5kW	TG-80	86	GrRe	-	**	IT/V
DICKEN,	WHITE CITY,	W-1.5kW		80	BaRe	?		
DUTCH INDUSTRIES,	REGINA,	HB-15kW	MG-71	84	GrCo	-		/P
GRAHAM,	LUMSDEN,	WTG		86	?	?		
JEFFRIES,	SASKATOON,	WTG		<81	?	?		
SASK. POWER,	CONDIE,	R-10kW	MG-55	82	GrRe	85	*&	VS/P
STEWART,	ARCOLA,	D-2kW		82	BaRe	<86	*	VS/LH

NOTES ON SASKATCHEWAN UNITS:
*--CREDA-funded. &--Mechanical problems, dismantled.
**--NRC IRAP-funded.

YUKON TERRITORIES

OWNER	LOCATION	TYPE	H/T	UP	ROLE	ST	NOTE	W/S
CARRUTHERS,	WHITEHORSE,	D-2kW	-65	84	BaRe	84	*+	LHF/
LIDDLE,	HAINES JUNCTION,	Y-1kW	-50	84	?	?	*	

NOTES ON YUKON UNITS:
*--CREDA-funded. +--never installed.

APPENDIX 3

TABLE 9: OWNER REPORTS OF RELIABILITY PROBLEMS

ALBERTA

Owner	Unit	Report
TransAlta	Bergey 10 kW	Four catastrophic failures due to high winds and turbulence.
White	Winco 1.5 kW	Gen. brush and rotor governor repairs.

BRITISH COLUMBIA

Owner	Unit	Report
Anderson	Winco 200 W	Shorted out generator windings.
	Jacobs 2 kW	Propellor needed rebalancing.
B.C. Tel	North 3 kW	Blades broke, bushings failed.
	Dunlite 2 kW	Blade and bracket failures.
C.C.G.	Dunlite 2 kW	Various mechanical faults.
Churchill	Winco 650 W	Bearings, gen. windings and brushes replaced.
Hadland	Dunlite 5 kW	Misaligned generator housing, burned out diodes, brake failure, rotor overspeed, blade hit tower.
Hamilton	Winco 200 W	Salt corrosion.
Handel	Home-b. 1 kW	Pin holding rotor sheared, transmission chain jumped gears.
Howard	Dunlite 2 kW	Moisture corrosion in generator windings and blade feathering mechanism.
Nicholl	Dunlite 5 kW	Improper blade feathering, blade broke.
Trask	Dunlite 2 kW	Rotor nose cone fell off, blades bent.
Warner	Winco 200 W	Salt rust, generator armature and brushes.
Wheeler	Elektro 6 kW	Worn bearings, poor quality control.

MANITOBA

Owner	Unit	Report
Klym	Enert. 4 KW	Control anemometer broken.

NEW BRUNSWICK

Owner	Unit	Report
Gionet	Helio. 7 kW	Brakeless rotor, belt drive, main shaft and blades broke.
N.B. Pwr.	Dunlite 2 kW	Severe vibration during overspeed so main bearings replaced, blades hit tower.
N.B. Tour	Dunlite 2 kW	Brake failure, rotor overspeed.
Noel	Ener. 1.8 kW	Blade tip air brakes need replacement.
Robichaud	Home. 4.5 kW	Blade failure.

TABLE 9 (cont.)

NOVA SCOTIA

Owner	Unit	Report
Aiken	Home. 100 W-	Blade failure.
Birch	Dunlite 2 kW-	Blade failure.
Browning	Winco 1.2 kW-	Blade failure.
Clark	Whirlw. 2 kW-	Vibration-caused mechanical problems.
Huss	Jaco. 1.8 kW-	Threw feathering flyball, rotor imbalance.
MacKay	Ener. 1.8 kW-	Brake problem.
Rogers	Bergey 1 kW-	Generator armature corrosion.

ONTARIO

Owner	Unit	Report
C.C.G.	Aerow. 30 W-	Fuses blown by power surges.
Courtney	Jacobs 3 kW-	Slip rings worn out.
Kidd	Well. 1.2 kW-	Broken tail weld and blades, poor slip ring contact, malfunctioned regulator.
McQuail	Canergy 2 kW-	Never worked well.
	Ener. 1.8 kW-	Worn Nearings.
Plowright	Whirlw. 2 kW-	Vibrated to pieces.
Snefjella	Therm. 100 W-	Generator brushes worn out.
Towsley	Dunlite 2 kW-	Bad blades.
Trans. C.	North. 2 kW-	Diodes blown by lightning, poor design of control electronics.
Webber	Winflo 500 W-	Blade failure.

PRINCE EDWARD ISLAND

Owner	Unit	Report
Howatt	Bergey 1 kW-	Blades broke in freezing rain.
Newman	Jac. 2.8 kW-	Rotor imbalance.
P.E.I. E.	Ener. 40 kW-	Generator and gear failures.
Wootton	Therm. 100 W-	Flip-up mechanism didn't, gen. burned out.

QUEBEC

Owner	Unit	Report
Smillie	Jacobs 2 kW-	Generator brush arcing.

TABLE 9 (cont.)

SASKATCHEWAN

Owner	Unit	Report
Sask. P.	Windw. 10 kW	-Blade fatigue cracks.
Stewart	Dunlite 2 kW	-Blade root fatigue, gen. mount failure.

YUKON

Owner	Unit	Report
Esso	W-200W	-Blown over and hit by polar bear.

TABLE 10: OWNER REPORTS OF BATTERY RELIABILITY PROBLEMS

BRITISH COLUMBIA

Harrowing	-Deteriorated from early improper use, too expensive to replace.
C.C.G.	-Problems caused by Dunlite voltage regulator system.
Handel	-Some corrosion of connections but little trouble.
Swets, C.	-Some battery case splitting from plate deterioration.
Wheeler	-Didn't get good early maintenance advice, aged fast.

MANITOBA

Dekker	-Needed several batteries in parallel to avoid burning out in high wind speeds.

NEW BRUNSWICK

N.B. Power	-Discharges because of energy going to induction.

NOVA SCOTIA

Browning	-First battery set was second-hand, in poor condition.
Henderson	-Always used second-hand batteries, mixed sets, some too old, but good price. Latest set is okay.
Huss	-48-volt batteries supposed to have 300 amp-hour capacity but never lived up, became ineffective.

ONTARIO

C.C.G.	-Failures result in winter freeze-up.
Plowright	-First Canadian Tire set lots of problems, then got CD Power set, kept topped up, avoiding deep discharge.
Snefjella	-Poor quality deep discharge.

TABLE 11: GOVERNMENT GRANT RECIPIENTS

PROVINCE	NUMBER	DISSATISFIED
Alberta	0	-
B.C.	1	1
Man.	7	0
N.B.	5	1
Nfld.	1	1
N.W.T.	2	0
N.S.	31	2
Ont.	1	1
P.E.I.	1	0
Que.	2	0
Sask.	3	1
Yuk.	2	1
Canada	55	8

TABLE 12: REASONS FOR UN- OR DISSATISFACTION

CREDA GRANTS

1. Good initial support but no contact in three years.
2. Was good except that many questions I asked about windmill technology they couldn't answer. I had to phone the U.S.A.
3. Only problem, very slow receiving money back from government.
4. Didn't have qualified people to advise about system. Already had small unit, was advised to buy larger one. Person on grant board sold batteries, inverter, but dropped business when all business from grants done, so no one to get repairs.
5. Support withdrawn in province for renewables, project left unfinished.
6. Never put up unit. Government hassles with grant infuriating. Got grid hook up instead, turbine now for sale.

INVENTOR INNOVATION GRANTS

1. Provided up to 50% of capital cost but nothing for operation, maintenance or development time.

TABLE 13: COMMENTS FROM OWNERS TO OTHER OWNERS

BRITISH COLUMBIA

1. Rent a recording anemometer for one year prior.
2. Go windsurfing, too.
3. Test site first.
4. Choose your site carefully.
5. Don't depend on wind (site speeds too low).
6. Don't buy this type of windmill if very wind speeds are very high (Canergy turbine).
7. Analyze costs avoided by utility (the grid-connected buy-back rate).
8. 110-volt system appears to be much more efficient than low-voltage for charging batteries the (the) case of a back-up gas generator and for electric motor use. Many power tools and appliances will run on 110-volt direct current too.
9. Live there a while before buying windmill.
10. Utility or back-up generator essential.
11. Put up a wind-run anemometer to give average speeds at each potential site.
12. One nearby Dunlite owner had to get his generator rewired due to corrosion. Correction to problem could be to drill a 1/4-inch hole at bottom of case for rain water drainage.
13. Think carefully before getting one as not every location is suitable.
14. Look for solar or microhydro or anything else first (poor quality control, many hassles with turbine).

MANITOBA

1. Wear a Safety belt when climbing the tower.
2. Get one that will produce what (you) require. Check to see at what height winds are more constant.

NEW BRUNSWICK

1. Get as much information as possible before buying or installing a windmill in your area.
2. Expect your windplant to put out 1/2 the annual kilowatt-hours advertised.
3. Choose your unit and site carefully.

TABLE 13 (cont.)

NOVA SCOTIA

1. Owners probably already know. Potential owners (should) talk to an experienced owner.
2. Important feature is self-adjusting propellor pitch to keep constant rotational speed regardless of wind speed.
3. Follow the experienced advice you get.
4. Do not deal with (fly-by-night companies).
5. Consider photovoltaic supplementary for your windplant.

ONTARIO

1. Over-rate all windmills to load required.
2. Make damned sure your supplier gets you the right weight of oil. Make sure you can't do it cheaper with wood or solar first.
3. Make sure you have a good procedure to learn effectively from other people's mistakes.
4. Stay away from battery storage except at remote sites where there is no other power source of a special application. Use the power for water or space heating.
5. Keep it going, get a good wind site.

QUEBEC

1. Make sure you like being your own lineman especially fifty feet up in January.

SASKATCHEWAN

1. Make sure you know what you are buying.
2. Consider real world economics closely. Stay away from unproven machines.

YUKON

1. Don't work with the government (frustrated grant recipient).

TABLE 14: OWNER COMMENTS ABOUT MANUFACTURERS AND SUPPLIERS

ALBERTA

1. Manufacturers should be aware of climate conditions. There are extremes, especially cold. More information should be available on wiring.
2. Tower that lowers to ground would be nice and make it easier for the small power producer.
3. Someone perhaps offer a course on maintenance and repair.

BRITISH COLUMBIA

1. Make more Jacobs turbines, truly the Cadillac of windmills.
2. Redesign (North Wind) blades, leading edge tape for some applications.
3. (Dunlite) voltage regulator system didn't function and led to battery problems. Spare parts were hard to get, many had to be made in machine shop.
4. Some (comments) unprintable. This (Dunlite) model was recalled. I wasn't informed till after recall ended. Supplier now considering helping financially.
5. Must be able to withstand very strong wind speeds.
6. Be more receptive to customer enquiries.
7. They stopped producing this (Dunlite) model because of problems with it.
8. Drill hole in (Dunlite) generator housing to drain rainwater to avoid wiring rusting.
9. Took 8 months to get unit due to dock strikes, poor communication with manufacturer, didn't know any local suppliers. Pieces were missing, inverter was inefficient.
10. Galvanize all metal parts to avoid rust at shore sites.
11. Supply complete, accurate schematics, get someone other than a flake to distribute product and have distributor carry spare parts.

MANITOBA

1. Would like an anemometer not made of plastic that doesn't have cups breaking off and doesn't cost $75.00.

TABLE 14 (cont.)

NEW BRUNSWICK

1. Use a brake system. Otherwise, no future for machine with high output.
2. Manufacturer contacted twice for information but gave wrong advice. Regional distributor knew nothing on installation or maintenance.
3. This machine (Dunlite) not rugged enough for this site and weather though was supposed to be a good design.
4. This windmill (Enertech) was too expensive for its rated capacity.

NOVA SCOTIA

1. Use larger generator to produce more watts.
2. We put shrink wrap plastic sheet on blades to shed moisture, ice. Manufacturer (Aerowatt) subsequently made teflon coated blades available as option.
3. Three sets of the metal blades (Dunlite) kept breaking. Now seeking wood blades.
4. Various mechanical problams due to vibration (Whirlwind).
5. Legal action should have been taken. Promises, promises.
6. Would like to see better-built governor.
7. Basically a fine machine.
8. Price (too high).

ONTARIO

1. Don't lie to or mislead prospective purchasers (Canergy).
2. Build it strong.
3. (Heating) water tank should probably be pressurized with pressure relief valve.
4. Was not very cooperative.
5. Design works well but could have been built for 1/2 the cost if the set up was engineered.
6. Better control electronics.

PRINCE EDWARD ISLAND

1. After-sales service was not good.
2. Keep working on the machine's technology and protective devices for ice and extremely heavy winds.
3. Ensure the spring for rotor flip-up (Thermax) is properly fitted before dispatch or this essential feature for storm conditions won't work.

TABLE 14 (cont.)

QUEBEC

1. Develop better method of generator voltage control in wind speed variations.

SASKATCHEWAN

1. Blade root fatigue should not be such a problem. Redesign tower with maintenance in mind. Eliminate vertical join in gearbox case (Dunlite), make generator mounting fail-safe. Unless parts supply is reliable, individual units even with back-up can't be considered reliable.

TABLE 15: OWNER COMMENTS ABOUT GOVERNMENT

ALBERTA

1. (Support) Class 34 (depreciation), tax incentives or a Level playing field and PURPA-like legislation.
2. Legislate guidelines for utilities and small power producers regarding (energy) banking, pricing and interconnection costs.
3. Both governments should be behind the small power producer and make it much better for them.
4. Someone should be offering courses in maintenance and repair.

BRITISH COLUMBIA

1. Abandon nuclear energy production, please!!!
2. Subsidized B.C. Hydro diesel generation plants for remote areas don't encourage people to use wind power or conserve energy. In Iskut, Hydro loses $2,000 per hook-up annually in subsidized costs to operate the diesel plants, so consumers don't face the true cost of remote power. Often wished Hydro would grant me $2,000 annually for not hooking up to their system and adding to their load.
3. Cut back on taxes.
4. Make legislation similar to PURPA in the U.S.A.
5. Recognize needs and contribution of alternative energy field. This community can get tons of money for public Hydro but none for independant, non-impact alternatives.

MANITOBA

1. Get into decentralized alternatives in a big way.
2. More support should be provided in general.
3. Give people tax breaks and incentives for wind power.

NEW BRUNSWICK

1. Subsidize people who have had a personal experience and investment in such projects, and asist them more, technically.
2. More than enough money has been spent on wind power R&D. We're now 're-inventing the wheel'. Technology has been developed.
3. More programs to many.

TABLE 15 (cont.)

NOVA SCOTIA

1. More support.
2. Reinstate the import duty exemption on renewable energy items.
3. If government continues to fund such projects, they should look closer at getting their money's worth.
4. Better legislation to control fly-by-night operators.
5. Have qualified people on their boards for giving grants that are unbiased and aren't in related businesses.
6. More funding.
7. More grants.
8. No nuclear power, please.

ONTARIO

1. Take tax off windmill sales.
2. Fund and help develop alternative and renewable energy sources and systems before they are desperately needed.
3. Help financially with initial cost!
4. Pity an outfit as good as Wellington Windpower hasn't gotten boost from government.
5. Create 'level playing field' for renewable energy.
6. More funding for advocacy and implementation.
7. Financial assistance would be helpful.
8. Use windfarms instead of nuclear generation.

PRINCE EDWARD ISLAND

1. Encourage more wind energy use by providing grants, as for solar panels.
2. I'd like to see more wind projects.
3. Help manufacturers more in wind machine technology advances.
4. I encourage grants to those experimenting in wind power and natural energy.

SASKATCHEWAN

1. Work with manufacturers to get into good with utilities.
2. Put development money into research for small, reliable and cheaper machines as opposed to demonstration programs.

YUKON

1. Cut the bureaucratic crap.

TABLE 16: OWNER COMMENTS ABOUT ELECTRIC UTILITIES

ALBERTA

1. It would take me a while to tell you about it (TransAlta).
2. Established buy-back worthwhile rate would be encouraging.
3. We favor a pro-grid hook-up lobby in general.
4. They (City of Calgary) are to be commended for their attitude.

BRITISH COLUMBIA

1. From 1975 to 1981, B.C. Hydro alternatively insisted that its technically impossible, too expensive, worthless to them. Shortly before a hearing into a 900 megawatt hydro electric project that I had been opposing because it was on a river that flowed peacefully past my farm, the utility provided a letter of agreement to purchase my excess electricity.
2. Not enough interest shown and it takes too long for any decision to be made.
3. We live on an island far enough from the mainland that it missed electrification when closer islands were getting it, and now the majority of residents are opposed to it because of the changes in lifestyle it would bring. We can't stop it from coming if enough people want it, but so far the people who do have been diddled and misled by Hydro, before being told it would cost $20,000 per household. Population 400, four households on wind power that I know of, two on wind and solar, five on solar and small hydro and one on water power alone.

NEW BRUNSWICK

1. They don't participate enough.

NOVA SCOTIA

1. Be more cooperative and supportive of alternative means of safe energy production.

ONTARIO

1. Buy-back rate not enough to be bothered with.
2. Utilities should be developing small scale, grid-interfacing systems, not just wind. Since they weren't doing it, we worked away on our own. They finally allowed hook-up but tried to discourage us doing the project. But they used our results in a paper they presented.
3. They should have a small handbook which should be given to prospective builders.

TABLE 16 (cont.)

SASKATCHEWAN

1. Its going to be uphill.

TABLE 17: UTILITIES WITH GRID-CONNECTED WIND TURBINES

Policies reported by turbine owners

UTILITY	POLICY	SELL	BUY	COOPERATIVE
ALBERTA				
City of Calgary	Energy banking	$0.04/kWh	-	Yes
TransAlta	Banking	$0.0545	$0.016	No
TransAlta	Banking	$0.052	$0.016	No
BRITISH COLUMBIA				
B.C. Hydro	Trailing block	$0.05	-	No
B.C. Hydro	(To announce)	$0.0642--$0.0447	-	So far
MANITOBA				
Manitoba Hydro	No buy-back	$0.04	No	No
Manitoba Hydro	Banking	$0.06--$0.0327	-	No
NEW BRUNSWICK				
N.B. Power	Buy-back	-	-	No
NOVA SCOTIA				
N.S. Power	No buy-back	-	-	No
N.S. Power	No buy-back	-	-	No
N.S. Power	Buy-back	-	$0.03	Reluctant
N.S. Power	No buy-back	-	-	Yes
ONTARIO				
Ontario Hydro	Buy-back	$0.135	$0.026	No

TABLE 17 (cont.)

PRINCE EDWARD ISLAND				
Maritime Electric	Buy-back	$0.11	$0.0354- -$0.0284	Yes
Maritime Electric	Buy-back	$0.10	$0.025- -$0.022	Yes
SASKATCHEWAN				
Sask. Power	Net billing	$0.042	$0.042	No
Sask. Power	-	-	-	Yes
Sask. Power	Banking	-	No	-